

APRIL/MAY 2023

DPH41 — SPECTROSCOPY

Time : Three hours

Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

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1. What is the cause of hyperfine structure in rotational spectra?
 2. Outline the effect of isotopic substitution on the rotational spectra of molecules.
 3. Homonuclear diatomic molecules do not show vibrational spectra. Why?
 4. Mention of advantages of ATR technique.
 5. Why are anti-stokes lines less intense than stokes lines?
 6. What is the principle of SERS?
 7. List four applications of UV-vis spectroscopy.
 8. What do you understand about selection rules in UV spectroscopy?
 9. What is the principle of Atomic Absorption spectroscopy?
 10. How does NMR imaging work?

SECTION B — ($5 \times 5 = 25$ marks)

Answer ALL questions.

11. (a) Discuss the rotational spectra of polyatomic molecules.

Or

- (b) Describe the quadrupole moment.

12. (a) Interpret the vibrational spectra to study the characteristic frequencies of molecular groups.

Or

- (b) Analyze normal modes of vibrations of CO_2 molecules.

13. (a) How is the structure of a molecule determined using Raman spectroscopy?

Or

- (b) Discuss FT-Raman spectroscopy technique.

14. (a) Write a note on Chromophore effect.

Or

- (b) Elaborate Frank-Condon principle to study electronic states.

15. (a) Explain how the chemical shift of NMR is applied to study the molecular structure.

Or

- (b) Explain Mossbauer spectrometer with a block diagram.

SECTION C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. What is the principle of Microwave spectroscopy? Give a detailed account on working of microwave spectrometer instrumentation.

17. Adapt the Fourier Transformation idea to construct a FTIR spectrometer. Mention its advantages over conventional spectrometers.

18. What do you understand about Raman shift? Explain the working principle of the Raman spectrometer with a neat diagram.

19. Discuss different types of transitions in organic molecules and metal complexes.

20. Elaborate hyperfine structure, hyperfine coupling of ESR.